SPECIFICATION

Apparatus and Method for Minimizing or Eliminating Shadows in Display Devices

Cross Reference to Related Applications

This application claims priority from U.S. Provisional Patent Application No. 60/454,975 filed March 6, 2003. The contents of U.S. Provisional Patent Application No. 60/4554,975 are fully incorporated herein by reference.

Background of Invention

Field of Invention

This invention relates to display devices, specifically to ways to minimize the effect of shadows on display devices.

Objects and Advantages

In the display of items for retail or non-retail purposes, it is important that the item be displayed in such a way that it appears attractive. When merchandise is displayed, the sale is often dependent on the effectiveness of the display in keeping the viewer's focus on the merchandise. This is particularly true in the case of eyeglasses, whether they be corrective glasses or sunglasses, because there are a large number and variety of glasses to display at one time. With such a wide number of eyeglasses and styles displayed at once, it is important that the viewer be able to focus on the eyeglasses themselves with as little distraction as possible.

The display of sale items is best accomplished with illumination adequate to draw attention to the merchandise being offered, but such illumination often results in considerable shadows being cast by the merchandise itself and/or display devices being used to support the merchandise. As an example, when eyeglass frames are displayed on a panel illuminated by spot or flood lights, the eyeglass frames and the holders being used to support them typically cast numerous shadows against the background panel. These shadows are unsightly and distract attention from the merchandise.

It is therefore a primary object of the present invention to provide a display device that allows items to be displayed with minimum impact from shadows caused by the items or their placeholders or support means.

A further object of the invention is to provide a display device that is simple, lightweight, and rugged in construction, is inexpensive to manufacture from readily-available materials, and is capable of a long life of useful service with a minimum of maintenance.

Prior Art

In previous display devices, either artificial light of natural light was used to illuminate the display items. The problem was that the light illuminating the display items also cast noticeable shadows upon the display background. These shadows were caused by the display items or the item support holders blocking some portion of the light and thus creating shadows. The shadows decreased the effectiveness of the display by drawing attention away from the display items. This invention overcomes that flaw by utilizing a translucent panel properly positioned apart from a background panel to "absorb" or diminish the shadows cast by the display items or their support/placeholders.

Summary of Invention

This invention relates to a device and method for the presentation of objects which minimizes the impact of shadows on the display. Display objects are attached upon or placed in front of a panel of translucent material. The panel of translucent material is affixed to or positioned in relation to an opaque panel or wall surface. The spacing between the translucent panel and the opaque panel or surface is critical to minimizing the impact of shadows cast by the display materials or

supports onto the translucent panel. The display items can be illuminated by natural or artificial light.

Brief Description of Drawings

The character of the invention, however, may be best understood by reference to one of its structural forms, as illustrated by the accompanying drawings, in which:

FIG. 1 is a perspective view of a display device incorporating the principles of the present invention and shown in use with multiple eyeglass frame supports.

FIG. 2 is a perspective view of a display device with glass shelving to support the display items.

FIG. 3 is a perspective view of a display device incorporated into a framework with a built-in background panel and utilizing with multiple eyeglass frame supports.

FIG. 4 is a perspective view of a display device incorporated into a framework with a built-in background panel and utilizing glass shelving to support the display items.

FIG. 5 is a perspective view of a display device incorporated into a framework without a built-in background panel and utilizing with multiple eyeglass frame supports.

FIG. 6 is a perspective view of a display device incorporated into a framework without a built-in background panel and utilizing glass shelving to support the display items.

FIG. 7 is a perspective view of a display device consisting of a translucent panel with multiple eyeglass frame supports mounted to a wall.

FIG. 8 is a perspective view of a display device consisting of a translucent panel with glass shelving mounted to a wall.

FIG. 9 is a perspective view of a display device consisting of a translucent panel with multiple eyeglass frame supports mounted to cables.

FIG. 10 is a perspective view of a display device consisting of a translucent panel with glass shelving mounted to cables.

FIG. 11 is a graph of the data illustrating the effect of 1) the color of the opaque, background panel and 2)the spacing between the translucent panel and the opaque, background panel on the shadows cast by the display items or support devices.

Detailed Description (of the Preferred Embodiments)

Referring to FIG. 1, which best shows the general features of one embodiment of the invention, a background panel 12 is part of a self-supporting display stand or framework 20.

The display device also includes a translucent panel, indicated generally by the reference numeral 10. The translucent panel is affixed to the background panel 12 so that a gap of between 1 and 185 mm separates the translucent panel 10 from the background panel 12. Stand-off mounts 14 are used to provide support for affixing the translucent panel to the background panel and establishing the distance between the two panels.

In this embodiment, overhead lighting 18 is provided as part of the display device. Item supports 16 affixed to the translucent panel support eyeglass frames as shown in FIG. 1. When light illuminates the display items, some of the light is blocked by the display items or the supports 16.

The inventors discovered that by using a translucent panel made of Plexiglas® and positioning the panel between 1 and 150 mm from the background panel, shadows cast on the Plexiglas panel were minimized and in some cases non-detectable to the naked eye. Spacing between the translucent panel and the background panel is critical.

Experimentation with different materials led the inventors to utilize a form of Plexiglas® for the translucent panel. This material was readily available from a commercial source and further minimized the effect of the shadows in relation to other materials.

The Plexiglas® used by the inventors is Plexiglas® Frosted Acrylic Sheet. It is manufactured by ATOFINA Chemicals, Inc. Plexiglas® Frosted Acrylic Sheet has the frosted look throughout the entire acrylic structure which makes it more effective than other "surface frosted" materials tested. There may be other sources of frosted Acrylic sheet available that are frosted throughout.

The thickness of the Frosted Acrylic Sheet tested was .236 inches (6mm) and sheets are available in thickness ranging from .08 inches (2 mm) to .472 inches (12 mm).

The inventors discovered that the background panel should be opaque and that white surfaces achieved the best results in minimizing the effect of shadows (see quantification of results below).

Fig. 2 shows another self-supporting display device similar to the Fig. 1 display device. In the Fig. 2 embodiment however, glass shelves are utilized to hold the display items. This embodiment also utilizes stand-off mounts 14 to affix the translucent panel to the background panel.

Fig. 3 shows an embodiment of the present invention where the background panel is built into the framework 20 of a display device that can be wall mounted or placed on a table or horizontal surface. This embodiment is shown in use with multiple eyeglass frame supports.

Fig. 4 is an embodiment of the present invention similar to the framework display model shown in Fig. 3. In the Fig. 4 embodiment however, glass shelves are utilized to hold the display items. This embodiment also utilizes stand-off mounts 14 to affix the translucent panel to the background panel.

In the embodiment of the present invention shown in Fig. 5, the background panel is not built into the framework 20. In this embodiment, the opaque, background panel is supplied by the surface to which the framework is mounted or placed upon. This embodiment utilizes a floor or wall or other opaque surface as the background. The design of the framework allows the translucent panel to be placed at a predetermined distance from the back of the framework, and thus at the same predetermined distance from the opaque surface.

The embodiment of Fig. 6 also does not have a built in background panel. It is different from the embodiment of Fig. 5 in that it utilizes glass shelving to hold the display items. Otherwise, this display device incorporates the same display design as the Fig. 5 embodiment.

Fig. 7 illustrates an embodiment of the present invention that utilizes a translucent panel with eyeglass frame supports. The translucent panel is mounted to a wall and the wall acts as the background panel/surface. Stand-off mounts act to position the translucent panel at a predetermined distance from the wall to which it is mounted. This embodiment dispenses with the framework of the display devices shown in previous embodiments. Advantages to this

embodiment include reduced material expense, greater flexibility of mounting location due to reduced space requirement and use of natural lighting or artificial lighting not part of the display device.

The embodiment in Fig. 8 encompasses the same design as the Fig. 7 embodiment except that glass shelves are utilized to hold the display items. This embodiment also possesses the same advantages as discussed above in the Fig. 7 description.

Fig. 9 shows an embodiment of the present invention that incorporates a translucent panel mounted to support cables. The cables can be attached to ceiling supports or horizontal wall supports so that translucent panel is positioned at a predetermined distance from an opaque, background surface. Stand-off mounts or similar positioning devices could be used to assure that there is a defined separation between the translucent panel and the opaque, background surface. This embodiment is shown in use with multiple eyeglass frame supports.

Fig. 10 illustrates another embodiment utilizing support cables and a translucent panel. Here, the cables support glass display shelves in addition to the translucent panel. As indicated in the Fig. 9 description above, stand-off mounts or similar positioning devices could be used to assure that there is a defined separation between the translucent panel and the opaque, background surface. The cables can be attached to ceiling supports or horizontal wall supports so that the translucent panel is positioned at a predetermined distance from an opaque, background surface.

Quantification of Results

An experiment was designed to quantify the effectiveness of the display device in reducing the shadows cast on the translucent panel. A display device similar to the one shown in Fig.1 was set up with various slots (grooves) made to hold a translucent panel and the background panel in place (in lieu of the standoff mounts shown in Fig. 1). The slots allowed the experimenter to easily adjust the placement of the background panel with respect to the translucent panel to quantify the relationship between panel separation (i.e., distance between panels) and shadow reduction. Slots were placed in the display devices so that the panels could be separated by the following seven distances as shown in Table 1:

	Table 1 Measured Distance Between Panels During Testing						
	1	2	3	4	5	6	7
Inches	.75"	1.5 "	2"	3"	4"	5"	6"
mm	19.1	38.1	50.8	76.2	101.6	127.0	152.4

The tester first measured the effect of panel separation by using a white background panel spaced .75 inches (19.1 mm) behind the translucent panel. The display apparatus utilized for testing purposes was similar to the display shown in Figure 1A with two overhead lights.

A GE Type 217 Light Meter was used to take the light readings. The Type 217 light meter is a pocket size, color and cosine-corrected, three-scale meter capable of directly reading illuminance from 10 to 1,000 footcandles. The light meter was first used to measure (in footcandles) the light incident on the translucent panel in three different areas: 1) top of the of panel, 2) middle of the panel and 3) bottom of panel. These first three measurements were taken directly under one of the lights and the results were tabulated. A piece of cardboard was then used to create a shadow and a light meter reading was taken in the same three areas (top, middle and bottom of translucent panel) to compare the light meter readings for the "shadow area".

The results from these measurements are shown in Table 2 in the "Under Light" column. The light meter readings are naturally highest at the top of the panel due to the close proximity to the light source. The test was then repeated with the measurements taken between the two light sources and at the same relative positions from the light source. These results are also shown in

Table 2 for comparison purposes in the "Between Lights" column. Table 2 reflects the data obtained with the panels separated by .75 inches (17.4 mm).

Table 2 Test Measurements Under/Between Lights (White Background Panel)		
Distance Between Panels .75" (17.4 mm)	Under Light (footcandles)	Between Lights (footcandles)
Top/Light	48	34
Top/Shadow	26	26
Center/Light	32	28
Center/Shadow	22	22
Bottom/Light	28	28
Bottom/Shadow	16	16

Table 3 shows the data for the measurements taken on the translucent panel with the white background panel spaced from .75 inches (17.4 mm) to 6 inches (152 mm) behind the translucent panel. All of these readings were taken directly under the light as previously described.

Table 3 Test Measurements Directly Under One Light With Various Distances Between Translucent Panel & White Background Panel (in./mm)							
Readings (foot candles)	.75/19.1	1.5/38.1	2/50.8	3/72.6	4/102	5/127	6/152
Top/Light	48	42	44	46	40	38	38
Top/Shadow	26	42	38	44	38	36	36
Center/Light	32	30	30	28	28	32	30
Center/Shadow	22	26	24	24	24	28	28
Bottom/Light	28	24	20	24	26	26	26
Bottom/Shadow	16	16	16	18	20	20	20

Table 4 shows the measurements taken for the same display setup as utilized in obtaining the data in Table 3 but with the readings taken between the lights instead of directly below one light.

Table 4
Test Measurements Between The Two Lights
With Various Distances Between Translucent Panel & White Background Panel (in./mm)

Readings (foot candles)	.75/19.1	1.5/38.1	2/50.8	3/72.6	4/102	5/127	6/152
Top/Light	34	25	33	33	38	40	40
Top/Shadow	26	22	30	30	32	34	34
Center/Light	28	23	28	28	30	30	30
Center/Shadow	22	20	26	26	26	26	22
Bottom/Light	28	20	20	22	24	23	30
Bottom/Shadow	19	18	18	18	18	18	21

The tests were then repeated to quantify the effects of the color of the background panel on the shadows cast on the translucent panel. Three additional colored panels were chosen and tested: black, silver and tan. The complete results from these tests are shown in the tables 5 and 6. Table 5 shows the results from measurements taken directly below one of the lights and Table 6 contains readings taken between the lights.

Table 5 Test Measurements Directly Under One Light With Various Distances Between Translucent Panel & Different Background Panels (in./mm)								
Readings (foot candles)		.75/19.1	1.5/38.1	2/50.8	3/72.6	4/102	5/127	6/152
S	Top/Light	34	30	30	28	30	30	28
I	Top/Shadow	20	24	30	28	28	22	22
L	Center/Light	22	20	18	22	20	20	20
V	Center/Shadow	12	14	14	18	18	16	16
E	Bottom/Light	14	12	18	18	18	18	18
R	Bottom/Shadow	10	8	12	12	12	14	12
	Top/Light	34	40	36	36	32	32	32
	Top/Shadow	18	32	34	32	32	28	28
T	Center/Light	26	26	24	26	26	26	22
A	Center/Shadow	20	20	20	22	22	20	18
N	Bottom/Light	20	20	18	18	20	20	20
	Bottom/Shadow	12	14	14	14	14	14	14
	Top/Light	20	18	17	22	22	22	22
B	Top/Shadow	16	13	12	14	16	14	18
L	Center/Light	18	12	13	14	16	18	18
A	Center/Shadow	12	8	9	10	12	12	12
C	Bottom/Light	12	8	9	12	12	14	14
K	Bottom/Shadow	6	5	6	8	8	8	10

Table 6 Test Measurements Between The Two Lights With Various Distances Between Translucent Panel & Different Background Panels (in./mm)								
Readings (foot candles)		.75/19.1	1.5/38.1	2/50.8	3/72.6	4/102	5/127	6/152
S	Top/Light	22	17	21	22	22	23	24
I	Top/Shadow	16	14	17	18	18	19	18
L	Center/Light	20	15	18	19	17	18	18
V	Center/Shadow	14	13	15	15	14	15	14
E	Bottom/Light	18	14	14	15	14	16	18
R	Bottom/Shadow	12	11	11	11	10	11	13
	Top/Light	24	22	22	25	26	28	30
	Top/Shadow	18	19	19	21	22	23	22
T	Center/Light	20	20	20	21	22	20	20
A	Center/Shadow	16	17	17	17	18	17	18
N	Bottom/Light	20	15	19	18	18	18	20
	Bottom/Shadow	14	12	12	14	12	12	16
	Top/Light	16	18	16	18	16	18	18
B	Top/Shadow	12	12	12	12	12	14	14
L	Center/Light	12	14	14	14	14	16	16
A	Center/Shadow	8	10	8	10	10	10	12
C	Bottom/Light	12	12	14	14	14	16	14
K	Bottom/Shadow	6	8	8	10	8	10	10

To summarize the results, the readings were categorized by whether they were a "light" reading or a "shadow" reading. All top, center and bottom readings were then averaged for all measurements taken under the light and between the lights. These are shown in Table 7 below. The next step was to quantify the overall effect of the different color background panels and the distance between panels on the shadow cast on the translucent panel.

The "shadow strength" was defined as the ratio of the (average light reading minus the average shadow reading) divided by the average light reading. This gives a general indication of the percent reduction in light due to the shadow. If a reading of 30 foot candles was taken at a spot either under a light or between the lights and a subsequent reading of 22 was taken after a

shadow was cast at that same spot on the translucent panel, the "shadow strength" would be (30-22)/30=27%. The shadow reading indicates that the amount of light has been reduced by 27%. Thus the available light after the shadow was cast on the translucent panel was 73% of the non-shaded light. If a light reading of 30 foot candles was taken and a subsequent shadow reading of 26 foot candles taken, then the shadow strength would be (30-25)/30=17%. Here the shadow cast on the translucent panel resulted in 83% of the non-shaded light. Thus the "shadow strength" gives an indication of how much light has been reduced by the shadow. The larger the "shadow strength" percentage, the darker the shadow.

Table 7

Average Test Measurements and Shadow Strength

With Various Distances Between Translucent Panel & Different Background Panels (in./mm)

Readings (foot candles)	.75/19.1	1.5/38.1	2/50.8	3/72.6	4/102	5/127	6/152
White Light	36.0	32.0	31.3	32.7	31.3	32.0	31.3
White Shadow	21.3	28.0	26.0	28.7	27.3	28.0	28.0
White Shadow Strength	41%	13%	17%	12%	13%	13%	11%
Silver Light	23.3	20.7	22.0	22.7	22.7	22.7	22.0
Silver Shadow	14.0	15.3	18.7	19.3	19.3	17.3	16.7
Silver Shadow Strength	40%	26%	15%	15%	15%	24%	24%
Tan Light	26.7	28.7	26.0	26.7	26.0	26.0	24.7
Tan Shadow	16.7	22.0	22.7	22.7	22.7	20.7	20.0
Tan Shadow Strength	38%	23%	13%	15%	13%	21%	19%
Black Light	16.7	12.7	13.0	16.0	16.7	18.0	18.0
Black Shadow	11.3	8.7	9.0	10.7	12.0	11.3	13.3
Black Shadow Strength	32%	32%	31%	33%	28%	37%	26%

As mentioned previously, the purpose of this display device is to minimize the effect of the shadows cast on the translucent panel. <u>Thus, the lower the shadow strength, the more effective the display device.</u>